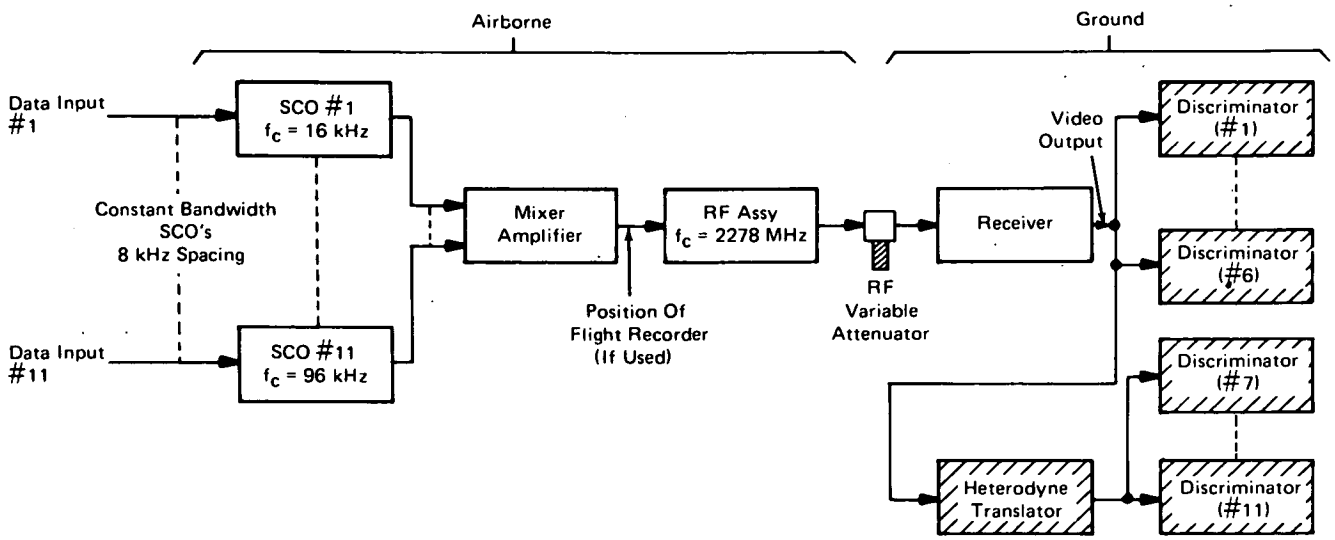
NASA TECH BRIEF

Marshall Space Flight Center

Pre-emphasis Determination for an S-Band Constant Bandwidth FM/FM Station



Telemetry users in the U.S. are limited to three frequency bands: 216 to 260 MHz, 1435 to 1535 MHz, and 2200 to 2300 MHz. At the present time, however, telemetry bands are being reassigned to UHF at 1500 and 2200 MHz. This change has raised a question concerning conversion of existing constant-bandwidth (CBW) FM/FM systems operating in the VHF band to the UHF band at 2200 MHz (S-band).

The conversion, however, is not as big a problem as it may appear at first glance. Primarily, changes are required in the equipment used in the RF link, while many of the same subcarrier oscillators (SCO's), mixer amplifiers, and frequency discriminators can be used.

In a recent study, pre-emphasis schedules were determined for 11 constant-bandwidth FM subcarriers modulating an S-band transmitter at three receiver signal-to-noise ratios (i.e., 9, 15, and 25 dB). It is anticipated that the use of one of the pre-emphasis curves with a telemetry system will ensure that approximately equal output signal-to-noise ratios for all channels in a decreasing S/N ratio situation can be obtained while operating at one of the three preselected S/N ratios. The CBW system used in the experiment is illustrated (see figure) with an alternate approach, represented by crosshatched blocks, to such system testing.

The pre-emphasis schedule for the system was obtained by operating the receiver at the IF carrier-to-noise ratio of 9 dB, while adjusting the individual unmodulated SCO outputs to produce identical subcarrier-to-noise ratios at the receiver video output. Measuring the subcarrier-to-noise ratio at the video output differs from the established practice of making the measurement at the output of the bandpass input filters of the frequency discriminators. This is more desirable since the results obtained are independent of any particular bank of ground discriminators. This technique establishes only the relative levels of the individual SCO's while the absolute level depends upon the bandwidth limitations placed on the total RF spectrum. The gain control on the mixer amplifier can be used to adjust the total multiplex level to achieve the desired spectrum bandwidth. This is permissible since small variations in the total multiplex level do not alter the relative relationships of the individual subcarrier-to-noise ratios.

(continued overleaf)

The measured pre-emphasis data are compared with the simplified analytical solution. If it is determined that inadequate performance is obtained because of the 9-dB IF S/N ratio; other pre-emphasis curves can be obtained for higher S/N ratios by repeating the procedure.

Notes:

1. Information concerning this innovation may be of interest to the designers and manufacturers of line-of-sight data transmission systems and associated equipment.
2. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.25
   (or microfiche $0.95)

   Reference: NASA TMX-64648 (N72-25182)
   Pre-emphasis Determination for an S-Band Constant Bandwidth FM/FM Station

Source: G. R. Wallace and
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